

SURGERY FOR VASCULAR MALFORMATIONS OF THE HEAD AND NECK*

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At New York University Medical Center we have treated approximately 300 patients with vascular lesions of the head and neck over the past several years. One hundred thirty of these patients were selected for combined treatment consisting of some form of embolization and surgical excision. The mainstay of treatment for vascular lesions of the head and neck consists of some form of preoperative embolization followed by surgical excision with the ideal goal of total removal of the mass. The distribution of these vascular lesions of the head and neck includes over 100 patients with vascular malformations, including arteriovenous fistulas and hemangiomas. Additional patients with other vascular lesions have been studied but will not be included in our discussion.

These patients present with multiple problems and each must be addressed in proper management of the patient. One concept that we promote is a team approach with joint evaluation of these patients by both the head and neck surgeon and the vascular radiologist. These two physicians form a partnership in the total treatment of the patients. These patients present with severe cosmetic deformities, commonly present since birth. Many have had progressive enlargement of these vascular masses producing severe cosmetic deformity, often resulting in psychological disturbances revolving around these tumors. Hemorrhage, occasionally of life-threatening proportions, accompanies the history of these tumors, especially with involvement of mucosal or skin surfaces. The mechanical traumatic effects and desiccation accompanying the normal functioning of the upper aerodigestive tract or the skin contribute to the possibility of hemorrhage with these extensive vascular masses. With involvement of various organs of the head and neck, functional

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problems may play an important role in the total debility that these patients suffer. Airway or alimentary tract involvement occasionally necessitates tracheostomy or feeding gastrostomy to bypass these obstructed organs. Speech, visual and auditory functions may also be impaired, depending upon the size and location of these masses.

A particularly difficult problem, for both the vascular radiologist and the surgeon, is a past history of multiple surgical procedures that have been performed by well-meaning surgeons in an attempt to control this disease. In the past, the surgical approach to these masses has concentrated on ligating the major feeding vessels or draining veins and, unfortunately, this has resulted in total failure with progression of the disease. In addition, major feeding vessels have been ligated, thereby reducing angiographic access to these vessels. The ability of these vascular malformations to assume blood supply from surrounding vessels has often resulted in an internal carotid distribution to these masses. Obviously, once the blood supply is parasitized from the internal carotid branches, angiography and subsequent embolization becomes much more hazardous. Occasionally, vascular reconstruction of previously ligated vessels has been performed to provide angiographic access, thereby allowing an extra margin of safety when treating these patients.

The goals of treatment have constantly to be kept in mind when evaluating these patients for proper care. The goals are addressed to the previously mentioned problems and one must remember that the treatment should be no worse than the disease. Improvement in cosmesis is especially important for younger patients, but is certainly welcomed by the older patients who have suffered severe cosmetic deformity for so long a time. Control or prevention of hemorrhage by elimination of the vascular malformation involving mucosal or skin surfaces is also an important goal. The multiple transfusions and anxiety reaction that severe hemorrhagic episodes produce may be eliminated with the proper procedure to control this problem. Restoration of function by debulking or elimination of tumors involving the airway or alimentary tract can be quite gratifying. Even if total resection is not contemplated, tumor regression and/or stabilization is an important goal which certainly can be well appreciated by the patient. These masses often have a relentless history of slow progression with increasing symptoms. Most recently we have noticed a correlation between hormonal influences and the progression of these masses. Not infrequently, the growth rate of these masses accelerates during menarche and pregnancy. We presently have embarked

upon different forms of hormonal manipulation to determine whether the size of these vascular malformations is affected by appropriate hormones.

The evaluation of each patient begins with a thorough history and physical examination. All prior angiographic studies and operative reports are reviewed and a complete head and neck examination is performed. Computed tomographic scanning of the involved area is invaluable for determining the extent of involvement on a three dimensional plane. Delineation of major vessels, fascial planes and bony or base of skull involvement is important in planning the surgical approach and for comparison to prior studies in determining the rate of tumor progression. Super-selective angiography is then performed to define the blood supply and flow dynamics of these lesions. It is important to stress that common carotid or external carotid angiograms are not sufficient properly to define the blood flow of these lesions. Superselective angiography of all available branches of the external and internal carotid system can better demonstrate the many components that often constitute these vascular malformations.

Various treatment options are available. Ideally, angiography is immediately followed by embolization, and surgical resection is attempted within 72 hours of the procedure. A total resection is planned, depending upon the experience of the surgeon and the extent of the vascular malformation. Often, total resection cannot be performed and a subtotal or partial resection is done, followed by an intravascular obliteration of remaining vascular malformation with extensive embolization techniques. Occasionally, the only goal may have to be treatment of complications without attempting to remove the bulk of the tumor. The hemorrhage or fistulization which occurs with the more extensive lesions are addressed without an attempt to resect the more deeply reaching portions of the tumor. Ischemic ulceration may also form in tissue adjacent to this tumor. This may seem to be a contradiction in terms because we are dealing with a vascular tumor; however, there is a steal phenomenon where the blood supply of surrounding normal tissue is preferentially shunted toward the vascular malformation, with resulting surrounding ischemia and the possibility of ulceration.

To reiterate, the treatment plan is determined after performing a computed tomography scan and angiography whereupon the decision as to resectability or unresectability is made. Resectable tumors undergo preoperative embolization and attempted excision. A total excision is performed if at all feasible. Occasionally partial resections are performed with subsequent total intravascular obliteration. If a malformation is deemed unresectable, these

patients undergo embolization without subsequent surgery. Surprisingly, many of these patients have returned for multiple courses of embolization with excellent stabilization of their tumors and their symptoms. Especially in younger patients, radically deforming procedures are avoided when possible, and multiple embolizations seem to be as effective in controlling many of these patient's problems. Fortunately, at New York University Medical Center we have a vascular radiology department with a superb knowledge of head and neck vascular anatomy and unusual experience with an acceptably low morbidity.

As previously stated, embolization may be used preoperatively to provide an increased surgical exposure with less intraoperative bleeding. Occasionally, patients who have undergone previous external carotid ligation require reconstruction of this vessel to provide angiographic access to the feeding blood supply. Therapeutic embolization is an accepted form of therapy in patients whose lesions are considered unresectable or when postoperative functional debility or cosmetic deformity contraindicate surgical operation.

The purpose of embolization is to obliterate the angio-architecture of these hemangiomas and vascular malformations. Prior to this procedure, certain criteria must be fulfilled. The vascular radiology team must have established a record of performing these procedures with a certain element of safety which precludes an unacceptable risk of mortality and morbidity. Additionally, superselective catheterization of the more distal supplying vessels is necessary to prevent unwanted migration of embolic material. Occluding the nidus of the lesion is important to preserve feeding vessels and to provide future angiographic access.

Various embolic agents have been used. The biodegradable agents include dura, blood clot, muscle and Gelfoam®. At the present time these agents provide no advantage over the nonbiodegradable agents, except that the use of Gelfoam® results in temporary occlusion of some of the larger vessels. The nonbiodegradable agents used at this time include Ivalon® and Cyanoacrylate®. These embolic materials are impregnated with tantalum, which provides radio-opaque characteristics to visualize the embolic material.

One lesion which does not fall into the previously mentioned category for embolization includes venous malformations. These are considered "low-flow" lesions. The arteriograms of these lesions are entirely normal, but the venous component is quite abnormal with occasional large cavernous components. These masses have been studied by direct percutaneous injection of contrast material with delineation of the venous sinuses. In attempting to

sclerose these low-flow lesions, 95% absolute alcohol has been injected through a percutaneous catheter resulting in immediate coagulation of the hemoglobin with intimal disruption. Initially, an inflammatory edema is followed by fibrosis of the vascular lesion. Smaller lesions have been controlled solely by alcohol injection, although postinjection surgery has been performed on these patients.

The management of the vascular head and neck lesions continues to evolve and, with refinement of vascular radiologic techniques, embolic materials and surgical approaches, more patients will benefit from the combined efforts that both the vascular radiologist and surgeon can apply to these problems.